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ENERGY

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USSR REPORT

ENERGY

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FUELS

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UKRAINIAN OIL DEVELOPMENT EXAMINED

Kiev NEFTYANAYA I GAZOVAYA PROMYSHLENNOST in Russian No 2, Apr-Jun 86 pp 4-6

[Article by V. A. Bugrov, A. Yu. Grosh, and Z. I. Smyk, InFOU AN UkSSR, Glavneftekhimprom UkSSR, and Gosplan UkSSR: "Problems of Developing the Oil Refining Industry of the UkSSR"]

[Text] The oil refining industry occupies one of the leading roles in the economy of the Ukrainian SSR. Along with further improving the volume of oil refining, the main stress in developing the republic's oil refining industry in the 11th Five-Year Plan was put on improving the technological arrangements of oil refineries (NPZ) and rebuilding them, improving product quality, and improving all the basic technical-economic indicators of production. One of the accomplishments of the oil-refining industry was the construction and development of the LK-6u combined facilities, which, along with preparing the raw material for refining and direct distillation of oil, provide catalytic reforming of the directly distilled fractions of gasolines, hydrorefining of diesel fuel and kerosene, and gas fractionation. The LK-6u facilities make it possible to obtain high-quality types of product at the level of their natural occurrence in the oil.

The yield of capital investments at a combined facility when compared with a system of separate facilities is approximately 15 per cent higher, labor productivity is higher by a factor of 1.5, the time to recoup capital investment is 20 per cent lower, operating costs are 10-15 per cent lower, and the area taken up is less by more than a factor of two.

Improving the technology and rebuilding existing plant was achieved by building isomerization facilities and facilities to intensify refining, by upgrading petroleum products, and by producing lubricants, petroleum bitumen, paraffin, and other products. The automation and mechanization of the production processes continued to develop. The national economic effect from losses of oil and oil products, estimated from long-run marginal costs [zamykayushchiye zatraty] in oil, came to 16.7 million rubles in 1975, 21.5 million rubles in 1980, and about 25 million rubles in 1985.

However, a complete balancing of the production and demand for oil products has still not been achieved in the republic, as a result of which, trade

turnover for inter-republic deliveries of oil products amounted to 30.85 billion kilometer tons in 1983, and transport costs determined by the production cost of shipments from the loading sites to the centers of territorial administrations amounted to 114.1 million rubles. As for the Moldavian SSR, which is within the weight zone of Ukrainian refineries, and the shipment of oil products to other union republics, the trade turnover came to 35.65 billion kilometer tons, and transport costs were 130.2 million rubles. And even though, in connection with the considerable increase in the volume of oil refined in 1985, inter-republic shipments of oil products declined by more than a factor of 1.5 when compared with 1983, the trade turnover for the developed structure of shipping oil products to the UkSSR and the MSSR amounted to 21.3 billion kilometer tons, and transport costs were 78 million rubles.

One of the factors affecting the development of the UkSSR's oil refining industry is the decline in the quality of oil delivered for refining. For example, the sulfur content of refined oil increased on the average from 0.49 percent in 1970 to 1.23 per cent in 1984. Because of the change in quality of the refined oil, the potential content of light oil products has decreased. This could not fail to affect the intensity of oil refining and the output of boiler fuel, which is approximately at the average union level.

In the mid-1980s there began a wholly new stage in the development of the country's oil refining industry, caused by the need for all-around intensification of social production and economizing on material and energy resources.

The distinguishing feature of oil refining is that the production of oil products is comparatively low in labor and capital costs, but high in material and energy costs. That is why the Main Directions cite as one of the primary tasks of developing the oil refining industry the need for ensuring further intensification of oil refining and a substantial increase in the production of motor fuels, as well as raw material for the chemical, petrochemical, and microbiological industries.

The urgency of the problem of intensifying oil refining can be explained by many objective factors, the principal ones of which are: the unique capacity of oil as a raw material for the production of a broad assortment of non-interchangeable products, the limitation of the resources and the non-replaceability of their reserves, and the steady decline in the technical-economic indicators of oil extraction in connection with its shift to unfavorable economic-geographic and natural-climatic zones, thus requiring large investments of funds, not only for the direct development of the oil refining industry and its ancillary industries, but also for the infrastructure.

Moreover, the demand for oil end products and petrochemical raw materials has begun to outstrip the production of oil and gas condensate.

We should note that the effectiveness of the growth of end products due to the intensification of oil refining is considerably higher than that due to increase in raw material resources. For example, increasing the intensity of oil refining by one per cent in relation to the structure of technological

processes on the nationwide scale requires additional investments to develop the oil refining industry on the order of only 385-450 million rubles, while the national economic effect, calculated by methodology [1] is estimated at 30-40 rubles per ton of additional motor fuel obtained.

The most highly diverse alternatives are available for the structure of the technological process of intensifying oil refining, including processes of increasing the output of the raw material (vacuum distillation of residual fuel and hydrorefining of vacuum gas oil), and of motor fuels (catalytic cracking, hydrocracking, moderated coking, thermocontact cracking, viscosity breaking of asphalt to produce boiler-furnace fuel, gas fractionation, and adsorption).

The technological processes for motor-fuel yields of 60 and 75 percent, as compared with the potential content of it in the oil, are listed in Table 1.

Type of Process	At level of potential content in oil	Yield, %	
		60	75
Direct distillation of oil	X	X	X
Catalytic reforming	X	X	-
Hydrorefining of diesel fuel and kerosene	X	X	X
Gas fractionation	X	X	X
Vacuum distillation of residual oil	-	X	X
Hydrocracking of vacuum gas oil	-	-	X
Catalytic cracking	-	X	-
Hydrorefining of vacuum distillate	-	X	-
Hydrodesulfurization of asphalt	-	-	X
Moderated coking	-	-	X
Viscosity breaking of asphalt	-	X	-
Hydrogen generation	-	X	X

Table 1. Options in Technological Processes for Oil Refining

Computations show that the more intense method of producing motor fuel is considerably more effective, because, with a motor-fuel yield on the order of 75 percent, the country's oil requirements are reduced by 30 percent, while the national economic effect amounts to at least 35 rubles per ton of motor fuel. Intensifying oil refining makes it possible not only to economize on the country's oil resources, but also to produce the high-octane components of automotive gasoline, and thus to eliminate the need to construct catalytic reforming facilities.

In fact, gasoline obtained from catalytic cracking facilities by the motor method has an octane number of 80, and a number of 70 by hydrocracking, while directly distilled gasoline fractions have an octane number from 56-60.

Moreover, resources of diesel fuel can be increased by making wide use of secondarily derived gas oil fractions, and by increasing the end boiling temperature of the fuel as a result of using both depressor fits [prisadki] and adsorptive, and especially catalytic, dewaxing of gas oil.

New highly effective GKD [not further identified] catalysts have been adopted at hydrorefining facilities, the use of which, in comparison to aluminum-nickel-molybdenum-silicon catalysts, reduces the equivalent unit energy consumption by a factor of 1.5 to 2, and improves the quality of the hydrogenation product (it reduces the sulfur content in diesel fuel from 0.2 to 0.1 percent).

Increase in output and improvement in the quality of automotive gasoline, and reduction in energy costs has been aided by the adoption of KR [not further identified] sulfur catalysts, which make possible a three to five point increase in the octane number of the reformate and an increase in the output of hydrogen-containing gas. Using zeolite-containing catalysts in place of aluminum-silicate ones makes it possible to increase the octane properties of gasoline by 10 points.

The Main Directions provide for expansion in the output of lubricants, and improvement in their quality. In the Ukrainian SSR 40 percent of total lubricants produced are automotive, 40 percent are industrial, and 20 percent are for other purposes. Traditional technological processes are used in the production of lubricants: vacuum distillation, deasphalting, selective and contact refining, and dewaxing. The quality and assortment of the lubricants of the Lvov Oil Refinery are unique. Lubricant quality can be substantially improved by using highly effective compounds for fits, as a result of improving the collection and reclamation of used lubricants, and by further expansion of plants. Increasing the production and improving the quality of oil asphalt is also an important problem.

In order to reduce transportation costs, the Main Directions have pointed out the need to continue the work of rationally siting production facilities for oil products.

There are two possible ways of solving this important problem: by taking a differentiated approach to the output of motor fuel and furnace fuel in the country's various regions in accordance with the resources of boiler and furnace fuel in particular economic regions, and by way of rationally siting oil refineries. The first method must be accomplished in the context of optimizing the country's fuel-energy balance and optimizing the oil industry (including the refining industry), and the second by building new refineries as a result of an overall increase in the amounts refined, or redistributing oil and oil refining capacities among zones of surplus or insufficient concentrations of oil refining.

Table 2 shows the effectiveness of constructing in the Southwestern economic area of the Ukraine a conventional oil refinery with a capacity of 12 million tons of oil per year, with the oil being delivered from Western Siberia, as compared with the shipment of oil products from the Ural-Volga area by rail.

Indicator	Construction of new refinery	Shipment of oil products by rail
Volume of shipment, million tons	12.0	10.8
Production cost, million rubles	24.9	86.8
Investment, million rubles	43.6	630.4
Costs incurred, million rubles	30.2	162.4

Table 2. Effectiveness of Constructing a Conventional Refinery, as Compared with the Shipment of Oil Products by Rail

Capital investment for rail transport, production cost, and costs incurred, were calculated for Table 2 by methodology [3]. When estimating investment for transporting oil, the existing network of oil pipelines has been taken into account.

It follows from Table 2 that building a new oil refinery in the Ukraine, by reducing transportation costs by 61.9 million rubles, investment by 586.8 million rubles, and costs incurred by 132.2 million rubles, would produce savings per ton of oil products of 5.7 rubles, 54.3 rubles, and 12.2 rubles, respectively.

The construction of this refinery would free rail transport from the shipment of oil products, and produce a better balance between production and demand.

The implementation of these intra-industry resources will enable the oil refining industry to rise to a higher level of quality.

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OIL, GAS DEVELOPMENT IN CASPIAN SEA

Baku AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO in Russian No 5, May 1986 pp 1-5

[Article by Kh. B. Yusufzade of VPO [All-Union Production Association] Kasmorneftegazprom [Caspian Sea Oil and Gas Production] under the rubric "The Geology, Survey and Development of Oil and Gas Fields": "The Results of Geological and Geophysical Operations in the Caspian Sea in the 11th Five-Year Plan and Tasks for the 12th Five-Year Plan"]

[Text] Some 15 oil and gas deposits with various geological and operational features were exploited in the Caspian Sea in the 11th Five-Year Plan. Of them, 12 oil and gas-condensate fields are in industrial development (Artem Island, Darvina Bay, Zhiloy Island, Gryazevaya Sopka, Field imeni 28 April, Neftyanyye Kamni, Peschanyy-More, Bulla Island, Bakhar, Bulla-More, Zhdanova Bay and Cheleken Island). The LAM Bay, Apsheron Bay and Alyaty-More were in industrial test production.

The production of oil on the Caspian shelf increased considerably starting in 1983 with the start of test operations at the Field imeni 28 April.

Notwithstanding the fact that oil production from the new field increased over the 11th Five-Year Plan, the proportion of production belonging to old fields remained high.

Fields in the later stages of development provided up to 80 percent of oil and gas condensate production over the 11th Five-Year Plan. The development of these fields was implemented at a rapid rate.

An intensification of the development of the fields was achieved through the continuous improvement of the development of accumulations, the broad application of secondary and tertiary methods, well drilling for remaining and unrecovered oil etc. About 75 percent of the total volume of oil production was obtained from stimulated strata. The use of active stimulation systems on accumulations ensured a high effectiveness of flooding for them. More than 38,000 cubic meters of treated and stratal water was injected into 40 facilities every day.

The increase of additional oil production through water stimulation totaled 20 percent of oil produced in 1985. The flooding process was especially

effective at the Neftyanyye Kamni Field, where 85 percent of all production was obtained by the flow method, and flow production totaled 40 percent of all extraction on 1 Jan 86. Experimental operations were conducted in stimulation for accumulations with oil reserves that are difficult to extract by tertiary methods.

In-situ combustion was employed at the Artem Island Field, and PAV [surface-active substance] and polymer injection was used at the Sangachaly-More--Duvannyy-More--Bulla Island and Neftyanyye Kamni fields. The thermal and physiochemical methods of stimulation employed on the accumulations made it possible to raise the extent of oil displacement and bring certain stringers under development. The incorporation of these and other methods made it possible to reduce the rate of oil-production decline by 3 percent in the 11th Five-Year Plan compared to the 10th.

The intensification of field development on the one hand, and the positive results of prospecting and survey operations in the 11th Five-Year Plan that provided for the growth of oil reserves on the other, were a solid foundation for increasing oil production on the Caspian shelf.

Prospecting and survey operations continued in the Azerbaijan, Turkmen and Kazakh water areas of the Caspian Sea in the 11th Five-Year Plan with the purpose of searching out new oil and gas accumulations and delineating those already discovered for productive (Azerbaijan sector) and red-mass (Turkmen) sections, as well as studying the oil and gas content of Mesozoic deposits (Kazakh section).

Geological operations in the water areas were carried out by the Kasneftegazgeofizrazvedka [Caspian Oil and Gas Geological Survey] for the purpose of searching out and preparing structures for deep-drilling prospecting. The amount of these operations is increasing constantly. More than 72,000 running meters of seismic profiles were extracted in the 11th Five-Year Plan, which is twice the volume of the 10th Five-Year Plan.

In the 11th Five-Year Plan, all detailing operations (about 40 percent of the total amount) were executed according to the 48-time accumulation system, which made it possible to increase the trustworthiness of the results obtained. Over this period, 26 structures were discovered and 15 were prepared for deep drilling.

In the Azerbaijan sector of the Caspian Sea and north of the well-known anticlinal structures of the Apsheron-Pribalkhansk Uplift Zone, a second line was discovered on which the Arzu, imeni Nakhichevanskiy, Abramovich and other structures were prepared for deep drilling. In a Middle Pliocene deposit complex on the Turkmen and Kazakh shelves, regional pinching-out zones were discovered that are favorable for hydrocarbon accumulation.

In the Central Caspian, a hose-shaped trap was discovered that is associated with the buried Paleo-Volga Valley and is interesting for prospecting for oil and gas accumulations. The systematic study of the shallow water of the North Caspian was begun in 1982. A number of promising formations for carrying out

prospecting and survey work were found in the maritime continuation of the Buzachi Arched Uplift.

Over the 11th Five-Year Plan, exploratory and survey drilling was carried out on 22 sites, including 16 in the Azerbaijan section of the sea, 5 in the Turkmen section and 1 in the Kazakh section. Over this period, three oil and gas fields and seven accumulations were discovered. The volume of exploratory and survey drilling totaled 444,000 meters, the construction of 69 wells was completed, products were obtained from 53 of them, and well productivity increased from 67 to 77 percent compared to the 10th Five-Year Plan. This made it possible to fulfill the plan for increasing oil, condensate and gas reserves by 102 percent, which was 35 percent greater than the amount of added reserves of all hydrocarbons compared to the 10th Five-Year Plan. The efficiency of exploratory and survey operations in increasing category $B+C_1$ oil and gas reserves per 1 meter of penetration was almost twice that of the 10th Five-Year Plan. The cost of preparing a unit of oil reserves with gas was lower than in the 10th Five-Year Plan. Exploratory and survey operations were prepared for industrial development at the Bulla-More Gas-Condensate Field (1981) and the Oil Field imeni 28 April (1985).

The following principal geological results were obtained for individual areas over the 11th Five-Year Plan.

The Apsheron Archipelago and the western portion of the Apsheron-Pribalkhansk Uplift Zone--Exploratory and survey operations in the water area were carried out basically in the areas of imeni 28 April, imeni Kaverochkin and Apsheron Bay. In 1985, exploratory drilling was begun in the Shakhovo-More and imeni 26 Baku Commissars structures.

The most important result in prospecting operations in the Caspian Sea in recent years was the discovery and placement into experimental operation of the Field imeni 28 April. Over the 11th Five-Year Plan, operations were continued here for the delineation of the accumulations found in stratum 10 of the Balakhan Formation and in the truncation formation of the northwest part of the fold. With the discovery of hydrocarbon deposits in KaS, PK and NKP [expansions unknown], the multiple-stratum nature of the field was confirmed. In 1985, the field was prepared for industrial development, the oil and gas reserves were estimated and confirmed at USSR GKZ [State Commission on Mineral Resources] and a development plan was composed.

There were 27 wells in operation on 1 Jan 86. Besides the four existing platforms from which well drilling and operations are conducted, the construction of platforms Nos 6, 10 and 11 is being carried out.

The Field imeni Kaverochkin was discovered on 12 Jul 85 by subsequent exploratory and survey operations in the western part of the Apsheron-Pribalkhansk Uplift Zone. (Footnote) (Yusufzade Kh. B. The Field imeni Kaverochkin in the Caspian Sea.--AZERBAYDZHANSKOYE NEFTYANOYE KHOZYAYSTVO, 1985, No 9, pp 7-9). In sampling of well 1 of the truncation formation (2,884-2,844 meters), a flow of 300 tons a day of oil was obtained along with 20,000 cubic meters of gas a day through a 12-millimeter choke where $R_{bPv=6}$ megapascals. The nature of operations at this well provides a basis for

proposing that the geological and geophysical features of field accumulations will be similar to those of the Field imeni 28 April.

In 1985, exploratory and survey operations were begun in the promising structures of the imeni 26 Baku Commissars (PPBU [mobile ocean-going drilling rig] Shelf-1) and the Promezhutochnaya (PPBU Shelf-3). The proximity of the latter to the oil and gas fields of imeni 28 April and imeni Kaverochkin on the one hand and Livanova-Vostochnaya Bay and Barinova Bay on the other predetermines the promise of their oil and gas content. Furthermore, exploratory drilling was begun in the Shakhovo-More area, promising basically for gas, where well 6 is being drilled from an SPBU.

The principal formation of exploratory and survey operations in the 12th Five-Year Plan, as in the last one, will be the structures of the Apsheron Archipelago and the western part of the Apsheron-Pribalkhansk Uplift Zone. Operations will be continued here on delineating the accumulations discovered in the Field imeni 28 April and the Field imeni Kaverochkin. Exploratory and survey operations will be continued in two areas in the Field imeni Kaverochkin--the delineation of accumulations that have been discovered and exploration for new accumulations of oil and gas in deep water accessible to PPBUs, where the the Shelf-2 PPBU is currently drilling well 5 at a depth of 180 meters.

An acceleration of operations at sites of the imeni 26 Baku Commissars, Promezhutochnaya and Shakhovo-More sites is envisaged along with the inclusion of exploratory drilling in the structures of Severo-Apsheron, Arzu, imeni Nakhichevanskiy, imeni Abramovich, Livanova-Zapadnaya Bay and others.

With the operational start-up of the Field imeni 28 April and the discovery of the Field imeni Kaverochkin, along with the fields being developed here and the existing promising structures, this region will remain the principal oil- and gas-producing region of the Caspian shelf in the 12th Five-Year Plan.

The Baku Archipelago--Exploratory and survey operations were carried out here in the Bulla-More, Sangachaly--Duvannyy-More--Bulla Island, imeni 8 March and Alyaty-More sites. The principal result of operations in the northern part of this region is the discovery of the Alyaty-More Field and the gas condensate field with an oil fringe imeni 8 March, located to the north of the Duvannyy-More Field. The oil and gas content of the Alyaty-More Field is confined to the 7th stratum of the PT [expansion unknown].

There are currently three exploratory wells (wells 6,8 and 15) in test operation with an average daily yield of more than 250 tons of oil. Operations for tracing the accumulations are being continued by four wells (wells 10, 11, 12 and 14).

The Field imeni 8 March was discovered by well 566 from the 7th stratum (5,476-5,465 meters) by a gas flow with a yield of 450,000 cubic meters and condensate of 80 tons (a 10-millimeter choke, R^b=26.0 megapascals). The exploratory well 578 begun subsequently determined the type of accumulation as gas condensate and oil. Operations for delineating the discovered accumulations is continuing at wells 577, 579 and 580. Although these

structures are small in size, the shallow water depth and their proximity to the developed Sangachaly-More--Duvannyy-More--Bulla Island Field increases their significance.

The outlines of the oil content of the 7th stratum in the northeastern limb of the fold (well 558) and the 5th and 6th strata of the PT in the southwestern limb of the Bulla Island structure were expanded through survey operations over the 11th Five-Year Plan on the Sangachaly-More--Duvannyy-More--Bulla Island site. Furthermore, according to the sampling data of well 570 (7th stratum, 4,846-4,821 meters), located in the southeastern part of the northeastern limb, a new oil-saturated block has been discovered that was earlier considered to be beyond the oil-content outline.

An accumulation in the 8th stratum of the PT was discovered in the Bulla-More Field in 1982 in the northwestern pericline of the fold. In formation sampling (6,097-6,088 meters) of the 8th stratum by well 56, a gas flow with a yield of 850,000 cubic meters a day and oil with condensate of 350 tons at R^{b}=24.8 megapascals through 16- and 16-millimeter chokes was obtained. This result permitted a considerable expansion of exploratory operations, although sequential wells 53, 70 and 74 turned out to be unproductive, which, apparently, is associated with the sporadic accumulation of hydrocarbons and is not a basis for disclaiming the promise of the accumulation. The exploratory wells being drilled should determine the further direction of survey operations.

The geological and survey operations permitted an evaluation of the reserves of the 5th and 7th strata and their confirmation at USSR GKZ in the 11th Five-Year Plan.

The continuation of exploratory survey operations for delineating the fields that have been discovered and the searching out of new accumulations, as well as individual oil- and gas-bearing sections that are limited by tectonic fractures and lithologic and stratigraphic variability of reservoirs, is envisaged at all of the fields indicated above in the 12th Five-Year Plan. Furthermore, explorations for hydrocarbons at the Andreyeva Bay site and other promising structures will be continued.

The Turkmen Sector--Explorations for oil and gas accumulations in the red mass (KT) and underlying red mass (PKT) continued in the 11th Five-Year Plan. At the same time, tracing tasks in accumulations discovered earlier in the Zhdanova Bay, LAM Bay and Livanova-Vostochnaya fields were resolved.

The outline of the oil and gas content of the 10th-stratum accumulation were expanded at the Zhdanova Bay Field (well 35).

An accumulation in the 4th stratum of the KT was discovered at the LAM Bay site (wells 51, 53, 16 and 20), and the oil content of the 8th stratum in tectonic block 4 in the eastern part of the structure was revealed.

The outline of the gas-condensate accumulation of the 8th stratum of the KT of the northeastern limb was expanded at the Livanova-Vostochnaya Bay Field, where a flow of 300,000 cubic meters a day of gas and 100 tons of condensate

through a 10-millimeter choke in sampling of well 15 at the 4,141-4,127-meter interval was obtained.

A continuation of exploratory and survey operations at the LAM Bay, Livanova-Vostochnaya and Gubkina Bay sites is projected for the 12th Five-Year Plan, and the start-up of deep drilling at Livanova-Zapadnaya, Zapadno-Okaremskaya, Fedynskogo, Fersmana and others is planned.

The Kazakh Sector--Exploratory drilling was renewed in the 11th Five-Year Plan in the Rakushechnaya-More structure in the Paleozoic deposits, the oil and gas content of which was proven at the Oymasha site. An accident occurred in the drilling process of well 4 at a depth of 511 meters, however, and as a result the well was eliminated.

Exploratory structure drilling was conducted at the Zhaga-More site. Along with the operations indicated above, mapping drilling continued as well.

The continuation of these operations in the 12th Five-Year Plan is projected for the Zapadno-Peschanomyskaya, Rakushechnaya-More, Tokmak-More and other sites.

Thus, the immediate tasks of the geological exploration and geophysical operations for the 12th Five-Year Plan are:

--concluding the supplementary exploration and delineation of the accumulations discovered at the Field imeni 28 April;

--continuing exploratory survey operations in the Fields imeni Kaverochkin, Livanova-Vostochnaya, Alyaty-More and imeni 8 March with the aim of evaluating the reserves and preparing them for industrial development;

--strengthening exploratory operations in the structures of the Field imeni 26 Baku Commissars, Promezhotuchnaya, Shakhovo-More and Andreyeva Bay;

--the placement of 10 new structures into survey;

--detailed geophysical operations in the shallow-water areas of the North Caspian and in the Azerbaijan, Kazakh, Turkmen and Dagestan sectors with the obligatory forecasting of the geological profile and its productivity; the complete implementation of the transition to the 48--96-time profiling of MOGT [expansion unknown];

--preparing 20 structures for drilling, including no fewer than 6 in the shallow-water areas of the North Caspian.

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DEVELOPMENT OF OIL INDUSTRY IN WESTERN SIBERIA

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 8, Aug 86 pp 29-38

[Article by V. Kozlov: "Petroleum of Western Siberia"]

[Text] Petroleum is one of our most important raw materials. It has now become difficult to find any area of the economy or of our industry that does not use oil or oil products. As our nation's production has increased, so has the demand for oil and the importance of its efficient use and management.

The present known oil reserves in our country are unevenly distributed. We have known and exploited the Baku oilfields for a long time and they have contributed to the growth of the oil industry of Bashkiriya, the Tatar Republic and other regions. At the present time, a leading role is played by the West Siberian oil and gas region (complex) in the Tyumen and Tomsk oblasts. The chief oil resources in this region are found along the Middle Ob and in the northern rayons. This is where the Samotlor, Fedorovsk, Ust-Balyksk, Western Surgut and other deposits were discovered. These fields began to be exploited in the middle of the 1960's and production has ever since then increased at an unprecedented rate. At the present time, this region produces more than 60 percent of all of the Soviet Union's oil. Such a displacement of our country's center of oil production had to have an effect on costs and oil economy.

Nevertheless, the accelerated development of the Western Siberia oil and gas complex has made it possible for our country's petroleum industry to continuously increase its level of production. Thus, over the period of 1981-84, the average yearly growth in oil production was 8.5 percent and the absolute increment amounted to 16.9 million tons while in the United States the same figures were 1.4 percent and 4.8 million tons, respectively.

During the 11th Five-Year Plan , the situation changed. At the beginning of the five-year period, the increment decreased in comparison to the previous year and in 1984 and 1985, there was a drop in oil production. The greatest shortfall in planned production occurred in Western Siberia. In the 15 years preceding this five-year period, that region's output made up for the reduced production in older oilfields but in 1983-85, these older regions again had to produce more oil than planned and they were unable to do so to the full extent needed.

Why did this happen? We will try to explain this using the example of the leading organization of the region, Glavtyumenneftegaz [Tyumen Chief Bureau for Oil and Natural Gas Production]. Aside from Glavtyumentneftegaz, oil is produced in Tyumen Oblast by the Bashneft Association and the Tatneft Association (since the beginning of 1985) and in Tomsk Oblast by the Tomskneft Association.

The activity of any organization can be examined from several perspectives such as how external and internal affect its work, objective and subjective factors, its structure and what comprises its production process, etc. Let us mainly consider the production process and look at other aspects as needed.

The process of oil (and natural gas) exploitation consists of geological prospecting, drilling, general construction (construction of facilities for basic production and infrastructure), production, preparation for transport and technical service (all forms of transport, power generation). Each of these stages of work is in itself a complicated process. When a deposit is opened and exploited, the designed, planned and actual relationships between these stages is established and this involves working out the proportion of resources (such as capital, workers, etc.) alloted them and the sequences and periods in which they are performed. The actual allotment of resources depends on many factors such as climate, the natural environment, the technical characteristics of the deposit and economic and technical capabilities. These proportions interact in a complicated manner and the degree to which the resources are alloted (or fall short) is often apparent only at a later stage. This is caused by frequent departure from the required ratios or to be more exact, by difference between the actual and planned proportions and the designed ones (although the latter may not be in all cases thoroughly justifiable).

In addition to the above, the oil and gas association as the basic production organization exploits several deposits and it therefore is unable to carry out the entire cycle of the listed operations. Geological prospecting, construction and technical maintenance are performed by specialist organizations of geologists, builders, transportation enterprises and energy bureaus). The scope and duration of the work they perform do not always meet the requirements of the main production process which is the extraction and transportation of petroleum. The problems of social infrastructure are a separate concern entirely and are even more complicated. If they are not properly resolved, they have a detrimental effect on the fulfillment of the oil production plan.

Here is a little history. An entire series of deposits were discovered by geologists and these were located along the middle stretches of the Ob River and its tributaries which provided convenient arteries for transportation. The oil deposits were situated at a rather shallow depth and were found to be "easy" to exploit (because there were easy to drill and gushed from their initially high yield). Exploitation of the region began with these deposits because they offered the best probability of success, the lowest costs, a rapid increment in production and a high pay-back in the investment. And so the work was begun.

In the end, the costs turned out to be significant and the working conditions difficult. Some of the problems were the remoteness from population centers and sources of supply, mud, bad roads (with supplies brought in during the winter over winterized roads and either airlifted or shipped in by river during the summer),

hard frosts and mosquitos. We must pay our respects to those who first came to this region and toiled. Thanks to their selfless work, the oil came forth and grew into a river. The output increased at unheard-of rates and the region soon became the country's chief supplier of oil.

The increased oil production made it possible to improve the fuel and energy balance, to a great extent satisfy the socialist community's demand for oil and to turn oil into the chief source of forign currency (partially due to the fact that there was such a sharp increase in world oil prices during the 1970's). The ease with which production was being increased led to a strange situation in which many sites began paying attention to another important aspect of oil production and that is social conditions.

The poor situation was not obvious at once. The logic of exploiting an oil deposit is such that at first the output continued to rise and the costs were low in comparison to what they would have been with full construction of infrastructure. In order to increase production, every possible well was being drilled, water was pumped in and the pressure between layers increased. With time, as the yield began to drop, it became necessary to increase costs in order to keep up production. Work scheduled for later dates was begun. This included mechanizing wells, creating and sharply increasing the capabilities of services responsible for maintaining and overhauling wells and drilling equipment, laying major roads and power lines to the drilling sites, increasing resources for oil processing and transport and for the construction of housing and other public facilities. The problem was not so much that this work was not done right at the beginning but that so little was done later. That is why the oil industry in Siberia have run into increased costs and lower output, a high turnover in personnel and other problems. At this time, costs are rising more and more and work is getting further behind. There is a shortage of capital and material resources, output and contractors, etc.

These are the principal causes of the complicated situation in the oil-producing regions of Western Siberia. The large deposits first opened up before 1971 have become largely worked out and this is most of all true of the most productive strata. Therefore, the amount of work being done at new deposits has not succeeded in making up for the drop in overall production at the old deposits. That is the natural cause of the changes there.

None of what has been said means that Western Siberia can no longer produce the necessary amount of oil. Geologists have estimated that the region has really only begun to produce its full capacity. Only a small portion of its potential oil resources have been exploited. Furthermore, this region has been explored and prospected much less than other oil-producing regions (in Azerbaijan, there are an average of 140 meters of exploratory shafts per square kilometer and in Western Siberia, only 16) and the "density" of wells in also very unevenly distributed. Another complicating factor is that most of the prospecting is being done further and further north and at ever greater depths.

The situation has also been complicated by a poor ratio between prospecting work* and operative drilling. Prospecting has fallen significantly behind and this circumstance is considered in planning that is in itself not always realized. That is why the resources are diminishing. When the region's first deposits began to be worked before the 1970's, exploratory and prospecting work amounted to 50 percent of all operations. This produced a surplus for increasing output. Recently, however, exploratory drilling has been reduced by 500 percent and this has affected the work of the entire industry. If the situation is to change, we must improve the ratio of prospecting to production. Domestic and foreign practice has shown that exploratory prospecting should comprise 25 percent of all drilling (and with regard to how far behind it has already fallen, this figure should be somewhat higher in our country).

However, in the opinion of specialists, it is not only important to increase the volume and percentage of prospecting but to change its structure as well. When the West Siberian fields were first being opened, the low amount of exploratory drilling revealed large deposits and a major front of work to be done in locating others. Now that the geological structure has become more complicated and the average yield of exploited deposits has diminished, the coefficient of successful prospecting has dropped and it has become necessary to increase the number of exploratory shafts. Therefore, the number of exploratory shafts will be increased by 30 percent during the 12th Five-Year Period and later to 50-60 percent.

Prospecting is directly associated with detailed geological research on finding and preparing new deposits for exploitation. We have fallen behind considerably in this area in the last few years. Thus, according to the Tyumen Chief Geological Bureau, drilling in 1975-1985 increased 1.6 times quicker than did the amount of geophysical research. As a result, the number of ready sites remained the same during the 11th Five-Year Period (the number of newly-prepared structures equalled the number of sites opened for drilling) and this limited the ability to screen "traps" for the prospect drilling. We are seeing an increasing number of "empty" wells, costs are rising and the entire cycle of prospecting work is becoming less efficient. Specialists feel that for the preparation of new sites, the best ratio would be three possible sites for each exploited one. To attain this, the rate of prospecting work should exceed that of drilling.

Geophysical work has been directed at finding general areas of work for geological prospecting. Thier success will be determined by the speed and quality of processing of reserach data. However, the computer equipment presently available to geologists cannot meet this task (only about 10 percent of the acquired data is processed). In the 12th Five-Year Period, considering the growth in the number of geophysical studies, it will be necessary to increase the ability to process data from these studies by 20-25 times.

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*Petroleum prospecting in the region is carried out by two departments, the Ministry of Petroleum Industries (10 percent of the drilling and 6 percent of the supplies) and the Ministry of Geology. The establishments of the latter fell more than 10 percent short of their plan for drilling and increasing supplies in 1981-1983.

We must take a separate look at departmental mentalities and the "conflicts" of interest between geologists and oilmen (we will consider this problem in connection with the attitudes of other departments). When a new deposit is found, geologists try to show that it has a high volume of oil while oilmen try to lower it. The problem is not at all simple. For geologists the most important matter is to increase the amount of confirmed oil reserves. With the existing prospecting technology, the oil supply is more reliable when geologists drill more wells, i.e. time and resources are spent but are insufficient. An unpredictable supply (because of both overestimation and underestimation of the oil supply in deposits) raises costs for oilmen. This is the objective basis of the contradictions between the two but there are still other aspects of the problem. In the end, it is the interests of the national economy that suffer. Because of differences in opinion and the changing of the most important indicators, the necessary documentation for exploitation of new deposits is too slowly approved. For that reason, it becomes necessary to put up new facilities with the documentation and to build the oilfields in several stages (which the specialists say increases their cost by 15 percent). Thus, because of imperfections in its design, poor consideration of future needs and departmental conflicts, the Samotlor oilfield had to be redesigned several times.

New deposits have had to make up for the shortfall in production at old oilfields and provide an increase in the oil supply. Out of the new deposits, half of them began to be exploited on schedule while the remainder were left for the end of the five-year period. In 1985, the plan for opening new wells went unfulfilled. The reason for this was that drilling and construction work was behind schedule. During the 12th Five-Year Plan ., 78 new deposits were supposed to be exploited and about twice as many wells were supposed to begin operating as in the 11th Five-Year Plan. This figure was increased somewhat in 1986 to improve the existing situation.

REGULAR UNFULFILLMENT OF THE PLANNED DRILLING HAS BEEN THE MAJOR CAUSE OF LOW OIL OUTPUT IN THE REGION. As we know, the Glavtyumenneftegaz Association failed to meet its quotas for both the five-year plan and the annual plans in 1982-84. The amount of drilling increased each year (in 1985, it had doubled its 1980 figure) but the rate of increment fell. Several other plans also went unfulfilled as well. It must be pointed out that the waiting time to begin operation of an oilfield and the wells in particular has several times exceeded the time spent on drilling. Therefore, the average period in 1982 was 83.6 and 20.3 days, respectively.

Success in drilling depends not only on the skill and organization of the drillers themselves but also on the work of their collegaues in other operations. WHERE A TYPICAL DRILLING CREW DRILLS ABOUT 49,000 METERS OF WELL PER YEAR, THE LEADING CREWS CAN DRILL MORE THAN 100,000 METERS. The latter make better use of equipment and better use of work time.

DRILLERS ARE BEING LET DOWN BY MACHINE BUILDERS, METALLURGISTS AND CHEMISTS. They are working under a constant shortage of equipment, pipes and reageants and the quality of what they do receive leaves much to be desired. A great deal of their drilling equipment is old and obsolete and new equipment is often incomplete. Oilmen then have to find the parts they need by themselves and

and lose valuable time doing so. It must be pointed out that equipment breakdowns in the region have costed drillers there more than 125,000 hours of time in 1985. Every crew has lost about two weeks time to repairs.

Machine builders are not only failing to always provide drillers with new equipment on time but they often fail to act on ideas developed by other industries. For example, geologists from Glavtyumenneftegaz perfected a design for a drill bit and the Verkhnesergiynsk Drill Bit Factory worked out its production but the All-Union Drilling Equipment Scientific Research Institute rejected the "outsiders'" idea without offering any of its own. There are many such examples of institutional obstacles.but there have also been cases of the opposite: THE NORTHERN PIPE FACTORY HAS ESTABLISHED CLOSE CONTACTS WITH THE SURGUTNEFTEGAZ ASSOCIATION AND WITH NIZHNEVARTOVSKNEFTEGAZ AND IS USING THEM TO CARRY OUT A SERIES OF PROJECTS (such as extending the length of threading in pipes, continuous pipe testing, etc.).

During the 12th Five-Year Plan , oil industry drillers face the task of doubling their work, mainly through increasing worker productivity. To meet this task, it will not be enough to simply improve work organization and discipline because completely new equipment is also needed.

One of the strongest friction points between oilmen and other industries is OILFIELD CONSTRUCTION including the construction of basic and auxiliary technological facilities, pipelines, roads, power lines, housing, etc. This work is done by construction organizations from several ministries and above all by the Ministry of Oil and Natural Gas Industry Construction and enterprises from many machine-building industries. Each department has its own work and what it does for the oilfields is not part of its chief operations (or to be more exact, oilfield construction work comprises only a small percent of their total commitments) so during the development and realization of a construction plan, it is usually the interests of the various departments that take the upper hand. Machine builders have been failing to provide equipment on time while builders have not performed all of the planned construction. Therefore, the plan for opening wells finished by builders has gone unfulfilled (so that according to Glavtyumenneftgaz, the five-year plan for well introduction is now behind by some 1500 wells) and construction work is behind schedule (at the end of 1985 alone, oil-processing facilities and the water reservoir at Endyrsk and the oil-gathering network at the Yem-Yemgovsk deposit were opened late while in January 1986, the Rodnikovsk deposit began producing oil but there were still no roads and construction was not yet finished).

Each of the construction organizations working in the region has its own problems but the one they all share is a shortage of rear services. Western Siberia has a poorly-developed production base for its construction industry and almost no raw materials. It has to bring in from almost all regions of the Soviet Union thousands of tons of construction materials every year. These shipments are made at a great cost to the national economy and tie up our transportation resources to their limit. Local geologists have suggested the region's considerable supply of diatomite as a construction material but there have still not been worked out the industrial processes for using it to make concrete, bricks and other construction materials (and specialists feel that this mineral would be a unique material). Geologists are unable to do this and builders are not too interested.

Finally, builders (including those responsible for public buildings) themselves have not been blameless in the present situation. A series of measures have been planned and undertaken. Other construction organizations from different republics and oblasts have now been brought together under a central administration. Additional capital, equipment and other material resources have been alloted. All of these steps have already had results. In our opinion, however, the main effort should be aimed at finding the correct ratio between the development of the oil and natural gas industries in Western Siberia on the one hand and the construction industry on the other hand and to maintain that ratio.

The workers of the petroleum industry also have their shortcomings too and the chief one is their DETERIORATING USE OF EQUIPMENT. Thus, out of all of the shafts in Glavtyumenneftegaz, the percentage of active ones declined from 95 percent in 1980 to 86 percent in 1985. The above-normal number of idle and inactive shafts is alarming. THE OPERATING FACTOR OF EXISTING SHAFTS IS BELOW THE INTENDED LEVEL. MEASURES TO MAINTAIN SEAM PRESSURE AND AUTOMATE PRODUCTION HAVE NOT BEEN REALIZED IN FULL. THE WORK OF UNDERGROUND CREWS AND SHAFT REPAIR CREWS HAS NOT BEEN STREAMLINED ENOUGH TO PROVIDE A HIGH DEGREE OF EFFICIENCY.

Unquestionably, adjacent industries have their share of the blame too. However, the region does have oilfield crews that are working efficiently in spite of all obstacles and these include the workers of THE YUGANSKNEFTEGAZ ASSOCIATION* WHICH DURING THE 11TH FIVE-YEAR PERIOD ATTAINED A CONTINUOUSLY HIGH PACE OF WORK AND REALIZED BOTH ITS FIVE-YEAR AND ANNUAL PLANS. Many of its work indicators are better than any of those achieved by Glavtyumenneftegaz (for example, the commercial rate of shaft-sinking was 35 percent higher and in Yuganskneftegaz it rose more rapidly).

THE ASSOCIATION HAS ACCOMPLISHED THIS THANKS TO ITS CONSTANT WORK TO INTENSIFY OIL PRODUCTION AND OTHER TECHNOLOGICAL PROCESSES. IT HAS BEEN INTRODUCING MODULAR AND PLATFORM METHODS OF WORKING DEPOSITS, HAS DEVELOPED CENTRAL WATER INJECTION OF LOW-YIELD SEAMS AND HAS ALSO QUICKLY CONVERTED ITS SHAFTS TO AUTOMATED PRODUCTION METHODS, ETC. These measures have already shown tangible results. It is making better-than-average (regional average) use of its shafts (in the Pravdinskneft Bureau, the period of shaft operation between overhauls has been extended to 504 days which is the longest in the industry). It has successfully carried out its planned introduction of new equipment and is mastering new techniques. During the current five-year period, it carried out 282 different measures which made it possible to save more than 51 million rubles. In 1985 alone, 57 new technological processes and types of equipment

* The Yuganskneftegaz Association was formed in 1977 from part of the oilfields of the Nizhnevartovskneftegaz Association. During the 11th Five-Year Period, it was operating 14 deposits. It provides about 20 percent of Glavtyumenneftegaz's oil and about 24 percent of the drilling. It contains 70 subdivisions including the Yuganskneft, Mamontovneft and Pravdinskneft oil and natural gas mining bureaus. The association has numerous times won socialist competitions and has also been awarded the Red Banner by the CPSU Central Committee, USSR Council of Ministers, the All-Union Central Council of Trade Unions. In 20 quarters since 1980, it has won the Red Banner award from its branch of industry.

were introduced and this produced a savings of 8.5 million rubles per year. In addition, the bureau saved two million rubles through its use of suggestions for greater efficiency.

The main basis for progress is work with people. The new conditions created by the realization of tasks set by the June 1986 Central Committee Plenum and an appeal by the CPSU Central Committee to workers of the Soviet Union have revealed entirely new prospects for using socialist competitions in the Western Siberian oilfields. The Yuganskneftegaz Association with its united worker collective is actively mastering advanced techniques and developing intiative. It has been paying much attention to the training of specialists and has a good number of educational resources. The association's subdivisions also have advanced training schools and all of this has produced substantial results. The association's organization of sponsored assiatnce is an example of cooperation and self-help. Many advanced specialists have gone over to more backward collectives to provide assistance. It must be mentioned that this form of assistance was provided by the workers of Yuganskneftegaz Association in 1985 to the Varyegganneftegaz Association to which it transferred many of its own best specialists along with several crews of workers to help adjust production and introduce new techniques. Measures taken to stabilize its work force and strengthen discipline have done much for the association (over the five-year period, worker turnover was cut in half and losses in work time were reduced by 250 percent).

Yuganskneftegaz has devoted much attention to economizing its operations. It has carried out regular but informal analysis of management activities. Its engineers are working along with its economic services and party aktiv to work out a production plan at all of its stages from the establishment of control figures to its final approved version. Nearly all of its subdivisions are now working on a cost-accounting basis for which a proper system of indicators has been developed. Assignments are sent directly to those responsible for executing them. Managers receive bonus pay if they see that the work of their departments is finished on time and is of good quality. Because of its efficiency and good economic results, the ministry has chosen Yuganskneftegaz as the site for an experiment for new forms of management (as of 1 July 1986). This experiment should help express the industry's own characteristics under the new conditions but it has been given very little time (a total of 6 months because the entire industry is supposed to begin functioning under the new system in 1987).

The association is carrying out a great deal of work to increase the construction of housing and public facilities. During the current five-year period, more than 4700 workers have been toiling to improve housing conditions. They have opened 11 kindergartens and preschools with space for 2170 children, a medical clinic with 180 beds and the Sibiryak sports stadium. In the end, however, this is still not enough and much more remains to be done. Generally speaking, the improvement of living conditions is one of the most sensitive problems in Western Siberia. There is too little housing, too few public facilities and nowhere to spend free time. This is not compensated for by higher wages and attempts to romanticize the work and these problems are causing a high worker turnover and increasing costs. Stint working can only alleviate the problem a little and at the present time about 100,000 workers are coming into the region from all areas of the country to do 15-day work stints. These people need

housing too. Practice has shown that normal living conditions produce more stable worker cadres and better work results.

The Bashneft Association has also been successful in its work in Western Siberia. At the beginning of last year, it was given responsibility for mining the Kogalymsk deposit which had previously been worked by the Surgutneftegaz Association. The deposit was not found to be in the best condition. About 400 shafts out of 1080 were standing idle. The oil production in January 1985 was 21,600 tons per day. The new crews got to work and within a year had drilled and opened 769 new shafts (48 more than planned). They used the industrial large-scale method of drilling out deposits by means of multi-shaft clusters, low-speed drilling and polymer solutions and automated and telemetric methods of oil yields and monitoring and control the work of equipment. By the end of 1985, these measures had made it possible to increase output to 40,000 tons per 24 hours.

These examples show THAT THE OIL-MINING ORGANIZATIONS OF THE REGION HAVE MEANS OF IMPROVING THEIR WORK. However, there still remains the problem of cooperation with adjacent industries.

Oilmen have many complaints about machine builders. We have already discussed some of these but I would like to mention two other problems. The first is that the industry needs not just high-speed equipment but equipment that is also able to function in the harsh conditions of Western Siberia and the Far North. The second is that complicated equipment needs service as is the practice abroad. In 1985, our own Ministry of Construction and Road-Building Machinery and in 1986 the Ministry of Automotive Industries created centers for exchanging parts and components for road-building machinery and automobiles at several points in the region. A similar initiative was undertaken by the Uralmash Production Association which is planning to set up in the northern regions of Tomsk Oblast a service organization for the maintenance of drilling equipment. Such measures must be taken everywhere.

There are also complaints about people in the power industry because the power lines are failing too often. The region's energy resources should be increased more rapidly than construction work and the production of oil and gas is rising. For a reliable energy supply, there must be reserve resources, power plants should be united into a single grid for the entire region and they must also be located not too far away from their consumers, etc.

In recent years, the central economic organs have made many decisions on the development of Western Siberia. Some of these have taken the form of developed programs which specify who will do what and how much, when and for whom. Even though these measures are necessary for the realization of certain tasks, they do show the poor planning and unfeasibility of plans.

PLANNING (and the entire management system) is still carried out by the extensive method. The scale of production and the number of establishments involved are growing and even more important, so is the number of planned (managed) jobs and the number of people needed to perform them. However, the availability of workers is affected by not only a general shortage of labor but also by certain economic considerations. On the one hand, this dictates a reduction in the number of

administrative and management personnel despite the fact that the demand for them is still growing under the existing, or to be more exact, employed technology. On the other hand, this deteriorates the quality of plans and their balancing.

The quality of plans depends a great deal on how detailed they are and the sort of norms applied. The establishment of workers in a ministry or some other central organ is not able to plan the activities of several hundred plants and organizations in any detail. The conclusion is that planning itself must be intensified and mechanized. We have the technical means to accomplish that. Finally, not all parameters of computer technology are satisfactory to planners. Computers are expensive and there are too few of them. However, we cannot lose time and we must actively pursue a new technology of planning and mathematical systems and also improve our methodologies.

At this point, it would be appropriate to mention the problem of the relationship between CENTRALIZATION AND INDEPENDENCE in decision making. The chief advantage of the socialist management method is that plans production with regard to the priorities of public interests. This does not mean that the center needs to plan everything down to the last detail. Even the ministries and departments do not always present the public interests. One cannot fall into the other extremity and take the idea of independence to the point of absurdity as some economists have done with their concept of "self planning". The realization of such suggestions leads to total disdain for social interests. Independence is not an end in itself but a means for greater and more efficient use of resources and for activating the creative initiative of the masses. The problem to be solved is that at every stage of growth, functions must be best distributed between various management levels with regard to the specifics of branches of industry and regions.

Unbalanced planning, uneven growth among industries and institutional barriers have to a large extent been caused by the lack of a central authority in the region. Western Siberia's chief contribution to the wealth of our nation is oil and gas. There are in that region many factories of establishments of other industries and all of these have their own interests. As experience has shown, to overcome institutional barriers, it is necessary to concentrate their efforts on achieving the main goal and the existing management system has unable to do that.

At one time, Gosplan USSR established the Interinstitutional Territorial Commission on Problems in the Growth of the Western Siberian Oil and Natural Gas Complex in the city of Tyumen in order to improve coordination of all of the regional organizations from various ministries taking part in the planned development of the complex. Beginning in 1982, this commission became involved in many of the decisions concerning interindustrial problems and the complex's social development as well as monitoring their implementation. The commission has unquestionably had a positive role in the growth of the power industry, transportation, social infrastructure and many other areas. Of course, the time has come to find new and more effective methods and to introduce them to the management of this complex. Possibly, the time has also come to reconsider suggestions about creating within this region a single organ responsible for

administering this complex and give it charge over construction and other organizations. Other variants may also be possible.

Therefore, the basic causes of unfulfilled plans for the production of oil and lower output in the region are: depletion of the largest of the exploited deposits and reduction of potential (in supplies and shaft output) of newly-opened wells (a natural factor); unscientific planning of the development of the complex, poor internal proportions to growth and bad cooperation with adjacent industries; and the lack of a single management center and the emergence of institutional (or local) differences.

It must be pointed out that these problems (in both the general and particular) can also be found among the natural gas industry of Western Siberia. This is the second leading industry of the region and is presently trying to hasten its work on deposits and increase output. It is important that the natural gas industry and its adjacent industries learn from the example of the oil industry.

The problems of the growth of the region are analyzed and resolved by the central administrative organs. A meeting of the collegia from ministries concerned with the region's development was held in Tyumen. The ministries there planned a developed program of activity and alloted additional financial, material and labor resources. The Bashneft and Tatneft associations are doing large-scale work at certain oilfields. At the beginning of this year, a Komsomol shock detachment was sent to Western Siberia. These and other measures have brought results and the situation is gradually improving. The oilmen of Western Siberia must now put all of their efforts, knowledge and experience into solving the task given them by M.S. Gorbachev during a visit to the region region: to successfully achieve the goals set for the 12th Five-Year Plan.

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IMPROVED SIBERIAN OIL FIELD DEVELOPMENT DESCRIBED

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[Article by N.Ye. Pavlov and A.S. Kuvshinov (Glavtyumenneftegaz), and Ye.P. Yefremov (deceased) and A.G. Telishev (SibNIINP) [Siberian Division of Scientific Research Institute of the Petroleum Industry], under the rubric: Intensification of the Oil and Gas Industry in Western Siberia": "Status and Ways of Intensifying the Development of the Oil Fields of Western Siberia"]

[Text] "Increase the effectiveness of oil recovery by using rational systems of development... by extensively adopting contemporary methods to increase the oil yield of formations, and by using advanced technological processes." (From the Main Trends for the Economic and Social Development of the USSR from 1986 to 1990 and the Period up to the Year 2000).

Developing the country's fuel base in Western Siberia has been one of the most important achievements of our oil industry in the past 20 years. In a comparatively short time 3.6 billion tons of oil and gas condensate have been produced. During the 11th Five-Year Plan more than 1.7 billion tons of oil and gas condensate were produced in Tyumen and Tomsk oblasts. The operating stock of producing wells increased during this five-year plan, and most wells are being operated with the use of the mechanized method of oil extraction.

In the initial period of developing the Western Siberian oil fields (1964-1970) row systems were mainly employed, with a relatively sparse well pattern (about 50 hectares/well). This density of well pattern, the joint exploitation of formations with a single filter, and the high productivity of the formations being developed under conditions that required the use of intra-contour flooding made it possible to increase oil recovery at a high rate: in the 10th Five-Year Plan alone the recovery of oil and gas condensate grew by more than 150 million tons.

However, experience acquired demonstrated that the development systems and methods of stimulating the formations did not ensure the plan level of oil recovery, which had been set at 55-60 percent of the oil fields in the Ural and Volga regions. Moreover, it was established that with the joint exploitation of formations by a single well pattern formations with poor collector characteristics were not involved in the development, and the use of equipment for simultaneous segregated exploitation and water injection did not yield the

expected results. With a five-row system of well spacing and a block width of five km, the central rows did not obtain the required effect from injection, and pressure formation in these zones fell 5-6 MPa below the initial level. A well density of about 50 hectares/well proved to be inadequate. As a result of drilling evaluation and supplementary wells, numerous zones and sectors were identified that had undeveloped reserves of oil. All this made it possible to conclude that it was necessary to employ intensified systems of development (three-row, area, and block-square) for formations that have varying collector characteristics. Adopting these made possible annual rates of withdrawal that exceed those of the oil fields in the Ural and Volga regions.

In turn, the increased volume of drilling operations, the rapid expansion of well stock, and the accelerated pace of developing systems to maintain formation pressure made it possible to considerably shorten the time needed to bring the oil fields to the maximum plan levels of oil recovery, and thus to ensure high economic effectiveness of development. During the 20 years of developing the oil fields here more than 100 million meters of rock have been drilled through, including more than 50 million meters in the 11th Five-Year Plan.

About 6,000 new producing wells were put into operation in 1985 just by the enterprises of Glavtyvmenneftegaz.

Breaking the development facilities into smaller units made it possible for Western Siberian oilfield workers to produce more than 50 million tons of oil and gas condensate between 1981 and 1985, and the wells drilled in that period in undeveloped zones produced 20 million tons, improving the system of stimulation (setting up additional injection lines and flooding points, and converting to the block-square system of development) produced more than 50 million tons, and the employment of non-steady (cyclical) flooding produced about 5 million tons. Therefore, intensified development should be achievable in the coming period, in the light of existing experience and improvement in it.

Solving the contemporary problems of developing the oil fields of Western Siberia will consist of solving the problems that apply to various types of oil and gas-oil pools (of high and low productivity), collectors (sandy argillaceous aleurolites and clays), and the physicochemical properties of the oil.

The highly productive pools of the B_8 formation of the Samotlor, Agan, Megion, and Vata oil fields, the A_{4-5} and A_{2-3} formations of Samotlor, and the B_{10} formation of the Fedorovo and other oil fields are being developed at a fast pace, and the well spacing employed (36-34 hectares/well) should ensure a quite high recovery of oil (45-68 percent). However, to maintain a high rate of oil withdrawal under conditions of increasing water cut there must be a considerable increase in withdrawals of liquid by mechanized methods, but this has been held back by a shortage of reliable pumping equipment (short time between repairs) and the delay in producing highly productive and reliable gas-lift equipment for extracting large volumes of liquid.

Because of the lag in adopting gas-lift units, 17 million tons less of oil and gas condensate were produced in 1985 alone than provided for in the five-year

plan. An attempt to ensure liquid withdrawal by using highly productive electric centrifugal pumps did not yield the desired result, because industry did not produce enough of them.

In 1985 the liquid withdrawal from highly productive formations was 82 million tons short of the technologically required volume.

Quite recently, 10 to 15 years ago, it was thought that such productive formations as B_6 of the Pravdinsk, and B_{10} of the Ust-Balyk and Yuzhno-Surgut oil fields, which had a permeability of 0.05-0.1 mkm^2, would be developed at a low pace of oil withdrawal. However, the accomplishment of certain technological solutions such as breaking facilities into smaller units (the B_{10} formation of the Ust-Balyk and Yuzhno-Surgut oil fields), and the adoption of block-square systems of development (the Mamontovo and Pravdinsk fields) has made possible quite high rates of withdrawal, and the oil recovery factor is expected to be 40-50 percent.

Wells of average productivity are thus being operated at the optimum. However, insufficient amounts of compressed gas at the Pravdinsk oil field have lowered the possibility of increasing the volumes of liquid recovery, and made it necessary to convert the wells to other types of mechanized oil recovery.

It was determined in the early 1970s that with joint exploitation of formations facilities with low collector characteristics are not involved in the development. It was therefore decided to segregate these formations into independent facilities in order to actively involve their reserves in the development. The productive formations discovered in recent years have generally been characterized by low permeability. In the future these facilities will determine the pace of developing oil recovery in Western Siberia, and therefore the problems of intensifying their development are of prime importance.

Among the low-permeable formations are those of the Achimov band (the Bystrin, Sredne-Balyk, Samotlor, and Agan oil fields), of the Verkhneyursk formation (the Megion, Vata, Mykhpaysk, Malo-Chernogorsk, and Tyumen oil fields), of the Sredneyursk formation (the Varyegan, Severo-Varyegan, Bystrin, and Vostochno-Surgut oil fields), the B_{8-11} formations of the Sutormin oil field, and the $A^1 1$ formation of the oil fields of Nizhnevartovskiy Rayon. The permeability of these collectors does not exceed 0.04 mkm^2. Depending on the depth of the position of the beds, the thickness of their oil-saturated layer and their confinement to the areas of development, the maximum economically exploitable oil reserves per well, when developing these formations, should correspond to a density of 16-36 hectares/well. The development of these facilities has been planned for the use of area systems, an injection pressure of 15-19 MPa, and the adoption of a mechanized method of extraction from the start of their development.

Special attention must be paid to problems of the qualitative opening up of formations, both in the process of drilling and when bringing in a well.

Promising results have been obtained by using NKT (PNKT) perforators

[through-tubing perforators]. For example, the use of PNKT at 50 wells in the oil fields of Surgutskiy Rayon increased the yield per well by 5-50 tons per day.

The problem of developing low-permeability collectors calls for a single methodological approach to evaluating the economic effectiveness of exploiting them. A technological base has still not been adequately developed for carrying out research on wells under conditions of mechanized oil recovery, and methods are lacking to estimate on-going oil saturation.

Among low-permeable facilities, the Bazhenovo series deposits are especially prominent. The results of test development carried out jointly since 1974 by Glavtyumenneftegaz and Glavtyumengeologiya have demonstrated the complex nature of their oil saturation. In the 10-year period the pool of the Salym oil field yielded about one million tons of oil, formation pressure in the withdrawal zone declined by 10 MPa, and the average yield of the 33 operating wells was 16 tons per day, of which 22 wells yielded one to five tons per day.

One of the major development problems is developing the productive deposits of the Tyumen series in Krasnoleninskiy Rayon, which differ from the collectors of the Mid-Ob region as to bed conditions and mineral composition of the rock. It was discovered by oil- field-geological studies that only the bottom part of the YuK_{10} formation has been developed, which lies in the lower part of the section, while the rate of advance of the injected water front, which has a cavity two to four meters in size, amounts to 560 m per year. It was further established that as the injected water approaches the producing wells, the productivity of the wells decreases by a factor of 10. After converting to a mechanized method of oil recovery, the initial liquid yield has not been reestablished.

Research on this phenomenon will continue. However, one may assume that water injection to maintain formation pressure should be carried out in strict differentiation, in accordance with the pressure and type of the collector. Another promising method in this rayon is the injection of high-pressure gas, especially for the low-permeable YuK_{1-9} formations.

Of the 52 oil fields developed by Glavtyumenneftegaz, eight contain oil and gas pools, which are distinguished by an extensive zone of oil-gas contact and a small oil-saturated structure. Their permeability varies from 0.03 to 0.4 mkm^2.

The greatest oil withdrawal has been achieved from the oil-gas pools of the AV_1 and AV_{2-3} formations of the Samotlor oil field. The achievement of the design solutions is at the initial stage in the Lyantor, Yaun-Lor, Bystrin, Fedorovo, Varyegan, Tagrinskoye, and Vyngapur oil fields.

With the joint occurrence of oil and free gas, sharply differing in mobility, there is a possibility of breakthrough, thus considerably complicating the extraction of the oil. Barrier flooding is employed (the AV^31 and AV_{2-3} formations of the Samotlor oil field, and the B_6 and B^28 formations of the

Varyegan field) to prevent the negative impact of large-volume gas caps on the operation of producing wells. Using this made it possible to obtain more than 1.8 million additional tons of oil in 1984-1985. This method will be widely used in the 12th Five-Year Plan.

In pools with small gas caps (up to two kilometers wide) conventional flooding methods are adopted, which provide for the injection of water into the gas cap. At the Lyantor oil field, where there are extensive sub-gas zones, area systems are employed, mainly for the bottom part of the formation, and with maximum utilization oif natural barriers. Because of the high gas content in the liquid produced, it is necessary to use the gas-lift method of operation, and to solve several methods of monitoring the development.

Block-square systems of development were widely used during the 11th Five-Year Plan in Western Siberia. They were employed at the following oil fields: Mamontovo (the B_{10} formation), Pravdinsk (the B_6 formation), Kholmogory (the B_{11} formation), and Karamov and Samotlor (the A_{4-5} formations), and in the middle part of the Vostochno-Mokhovsk area (the B_{10} formation) of the Fedorovo oil field.

Considerable expansion of the so-called "closed" system of development was noted in the 11th Five-Year Plan, which, like the block-square systems, made it possible to more widely exploit the possibilities of non-stationary flooding resulting from changes in the direction of the filtration sources.

All the methods of intensified development cited are aimed at increasing the current recovery of oil, and most of all at achieving high ultimate oil recovery.

Along with these, Western Siberian oil fields carried out small-scale research-industrial tests in the 11th Five-Year Plan on new methods of increasing oil recovery: the injection of aqueous alkali solutions, PAV [surfactants], gas under high pressure, etc. These resulted in additional recovery of more than one million tons.

Moreover, research-industrial studies have revealed the considerable effectiveness (about 15 tons of oil per ton of surfactant) of injecting low concentrations of surfactant solutions (0.05-0.1 per cent). In connection with this, research began in 1985 on the technology of injecting surfactant solutions at a concentration of 5-10 per cent, to create "one-time" fringes, whinh have produced good results in the oil fields of Tatariya. It can be assumed, however, that under actual conditions the injection of surfactants at this concentration through established lines of flow will be more effective than in the laboratory. Aqueous surfactant solutions must be in a system where filtration sources change direction. Closed systems of development are more effective for these conditions.

Experimental studies on the injection of gas under high pressure have been going on for about two years at the Samotlor oil field. Somewhat more than 500 million m^3 of gas have been injected into the formations. At some wells this increased oil recovery and reduced the water cut. However, it is still too early to speak of results.

Injecting alkali at the Trekhozernoye oil field was not very effective (11 tons of oil per ton of alkali), but employing a modification of alkali flooding (silicate-alkali), and the addition of other compounds made it possible to improve development indicators and expand the adoption of this technology to the oil fields of the Krasnoleninskneftegaz Association.

It has been possible to develop the highly viscous oils of the Russkiy oil field by employing intra-formation combustion, and the injection of air (12.6 million m^3) and the initiation of combustion were maintained for nearly a year. More large-scale studies are required to solve the problems of the possible oil recovery factor and the collection and transport of the oil produced.

Despite the positive results of employing physicochemical methods to increase oil recovery, highly effective surfactants have still not been developed, and serial production has not been started of block-unit automated compressors or of shutoff and regulating gear. The deadlines specified for their production will not meet the requirements of the oil industry.

During the 12th Five-Year Plan Glavtyumenneftegaz plans to produce more than 100 million tons of oil and gas concentrate as a result of intensifying development. To do this it is necessary, on the one hand to increase the reliability of oil field equipment, and on the other to furnish oil-producing enterprises with the means to monitor the operation of the wells and the parameters that make it possible to evaluate the degree to which the reserves are being developed.

The development of the Western Siberian oil fields is also being complicated by the following factors. Geophysical research methods have too little resolving power under conditions where formations of little depth frequently alternate. Measurements of the output of wells with increased gas factors have a large error factor. Despite the positive experience of determining the water cut of a well by using a resistance meter, which was obtained more than 15 years ago in the oil fields of Bashkiriya, this method has not been widely adopted. Water cut continues to be measured by periodic sampling with a bottle, which is clearly inadequate for monitoring. On-going oil saturation is determined by geophysical methods, for example by way of changes in saline solutions, which are time consuming.

Automating studies to monitor the operation of every well is the main direction for solving the problem of intensifying oil recovery. The knowledge of VUZes and the academies must be involved, along with our industry's institutes, with the problems of increasing the effectiveness of developing the oil fields of Western Siberia.

The results obtained therefore demonstrate that the systems of stimulation employed and the technology of development meet the contemporary level of scientific development, and advanced experience at home and abroad, and ensure high rates of oil extraction and high oil factors. However, the technology of

well injection is not solving the problem of maintaining the natural properties of producing formations.

Without the accelerated adoption of scientific and technical progress in the area of improving the effectiveness of development and the employment of highly reliable technical means of oil extraction, the required increase in oil recovery from formations cannot be ensured.

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RAISING LEVEL OF COAL EXTRACTION IN KUZBASS

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[Article by Kuzbassugol [Kuznetsk Coal Basin] VPO [All-Union Production Association] engineer V. M. Abramov and Candidate of Technical Sciences L. A. Zapadinskiy and VNIMI [All-Union Scientific Research Institute of Mine Surveying] Siberian Branch engineer A. S. Yagunov under the rubric "The Economy and Efficient Utilization of Material, Fuel and Power Resources": "Raising the Level of Coal Extraction in the Kuzbass"]

[Text] The level of coal extraction is an important indicator characterizing the activity of coal-producing enterprises and the sector overall. Operating and general mine losses and measures for reducing them have an effect on the value of this indicator. With an annual underground production of 78.8 million tons of coal over the 10th and 11th Five-Year Plans for the Kuzbassugol VPO, the level of extraction increased by 4.3 percent as a result of the incorporation of mechanized units that correspond to seam thickness, an increase in the amount of production using pillar-free processes and the improvement of the system for developing and re-activating coal reserves from protective pillars under different types of developments and natural entities.

The actual level of reserves extraction for 1984 was 77.6 percent, and was achieved basically through reductions in operating losses.

In the future, the reduction of operating losses will stabilize somewhat, while general mine losses will decline considerably through an increase in the re-activation of reserves.

The greatest reduction in operating losses in the 11th Five-Year Plan occurred as a result of the utilization of the pillar-free production process, through the employment of which 37.4 million tons of coal were produced in 1985 for the Kuzbassugol VPO, which was 58 percent of the coal production from seams at an angle of up to 35 degrees. Currently more than 160 integrated mechanized walls are being worked using the pillar-free process with an average daily load of 995 tons of coal. Over the last 10 years, integrated mechanized faces of inter-post pillars have extracted an additional 6.5 million tons of coal that was earlier irretrievably lost in the working space.

Three principal types of pillar-free processes are employed in the mines of the Kuzbass: the preservation of workings for full sections (with their repeated use) with the aid of the erection of artificial enclosures; the execution of workings at right angles to the working space; and, the partial preservation of the workings with their subsequent removal along with the protective pillars of the adjacent walls. An increase in coal production through pillar-free processes occurred in the 11th Five-Year Plan basically as a result of the use of the first two of the processes indicated above (94 percent of the instances of the use of pillar-free processes in the basin).

Pillar-free processes are employed most successfully in the mines of the Severokuzbassugol [North Kuznetsk Coal Basin] and Yuzhkuzbassugol [South Kuznetsk Coal Basin] associations. Rock-pressure groups have been created there which, utilizing existing standard documentation, are developing specific recommendations for protection logs and the upkeep of workings, are rendering methodological assistance to the miners for their incorporation and are providing for the monitoring of the fulfillment of the recommendations. The Severokuzbassugol Association, under the difficult conditions of inclined seams (lying at an angle of 25-35 degrees) is incorporating the most progressive version of pillar-free technology--the preservation of stoping gateways and their repeated utilization in the working of adjacent walls. Recommendations have been developed and industrial testing has begun of pillar-free technology in the Prokopyevsk-Kiselevsk region on seams lying at an angle of up to 60 degrees and with an extractable thickness of up to 2 meters.

Progressive experience in the operation of integrated production teams in the basin using pillar-free processes is being widely covered in the periodical press and scientific publications and is being disseminated among engineering and technical workers and in workers' collectives. The advantages of pillar-free processes, however, have still not been fully realized, since their incorporation is in many cases implemented without changing old traditional processes for preparing and working stoping areas. As a result, the concentration of mining operations declines in the working of two-sided stoping areas and there exist cases where the types of supports and the parameters of the logs for reinforcing and maintaining stoping drifts do not correspond to the mining and geological conditions of the seams being mined. It is also necessary to improve technological discipline in the incorporating sections and supply the mines with a large volume of metal yielding support framework.

Operations are being conducted on incorporating progressive solutions in the sphere of ventilation and fire safety in the pillar-free slicing of thick gently sloping seams given to spontaneous combustion; the highly efficient drilling of blast-holes for roof anchor bolting and the mechanization of this process; and, the manufacture of series-produced mechanized supports for junctions for workings intended for repeated use. In the sphere of the geo-mechanical basis of pillar-free technology in seam mining, promising questions of the efficiency of employing this method under the following conditions are being researched: in an earlier tapped rock mass with various frequencies of

working and various types of roofing; in the highly efficient hydraulic method of stoping gently sloping seams; and, with an irregular and complex steeply inclined seam bedding.

In order to improve pillar-free processes and further expand the sphere of its application on a broad scale of mining conditions in Kuzbass seam mining, the engineering and technical service of the Kuzbassugol VPO and of the associations and mines, in conjunction with the colleagues of VNIMI, KuzNIUI [Kuznetsk Scientific Research Institute of Coal] and other institutes, have developed proposals and practical recommendations that are utilized in the future planning of the development of mining operations. These recommendations envisage:

--new stoping areas prepared with side gravity planes (inclines) that make it possible to ensure uniflow ventilation, the delivery of materials to the protected working regardless of the extraction operations, the execution of cross workings in time periods optimal for mining pressure and under favorable conditions for the transportation and installation operations in the wall;

--in active extraction blocks without side gravity planes (inclines), stoping faces prepared and worked through one extraction column, which will make it possible to have in operation two stoping and three or four development faces in a two-sided stoping area;

--in the preparation of new stoping areas, preventive operations conducted for draining flooded seams with the aid of drainage workings, wells and the uptake procedure of wall working;

--the preparation and working of walls in stoping areas with the presence of side inclines conducted in a joint process with the formation of a second stoping area for the stoping face and its preservation at the edge of the coal body, which will permit an improvement in the conditions of working maintenance through a reduction in their service life;

--cross workings executed with a break in time between between stoping and preparatory operations of no less than 2 months for easily caved roofs, 4 months for average ones and 6-7 months for difficult ones;

--in order to provide for pillar-free processes in the hydraulic method of extracting gently sloping seams, the use of series-produced supports of an enclosure type with a frontal mobile unit, which permits an increase in the safety of operations and a considerable reduction in operating losses of coal.

Furthermore, a number of measures were developed that will also permit a substantial improvement in the future of the state of extraction workings with pillar-free processes of seam extraction through the application of modern support materials and organizational measures. In upcoming years, the production of coal using pillar-free processes is projected to be brought to 50.9 percent of all underground production for the stoping faces of the Kuzbassugol VPO, which will permit an annual reduction of coal losses in the amount of 1.5 million tons.

Thanks to the improvement of the opening of stoping areas through an increase in wall length from 100 to 120 meters and stoping pillars from 600 to 1,200 meters, operating losses of coal in the block are being reduced by 14 percent. The incorporation of 30KP-70, 4KM-130, 2UKP and other mechanized units of a new technical level permit the implementation of extraction in thick seams without leaving coal benches in the seams in the roof or floor, that is, the extraction of seams to their full thickness. As a result of this, operating losses for the basin are being reduced by 500,000-700,000 tons of coal a year. Furthermore, a reduction in these losses of coal is facilitated by increasing the proportionate participation of mining systems with relatively low losses in overall production (long-pillar mining, the use of systems with the flushing of the working space) and a reduction in the share of development systems with high losses (sluice systems). Operating losses are also being reduced considerably as a result of the working of flammable, irregular steeply inclined seams with systems using flexible coverings and hydraulic breaking without leaving block pillars.

By the end of the 12th Five-Year Plan, operating losses in underground production will be reduced by 0.5 percent and will total 16.1 percent.

An important area in reducing general mine coal losses that ensures a lengthening of the service life of levels and an improvement in the technical and economic indicators of mines is the re-activation of reserves under residential and industrial developments of cities and natural entities. This problem is extremely topical, since about 1.5 billion tons of coal is currently placed in reserve in permanent pillars in the mines of the Kuzbassugol VPO.

The large volume of laid-up reserves and their extremely irregular distribution among the associations is caused principally by the irrational development of the coal-bearing territories in the pre-war and early post-war years, as well as the specific conditions of developing the fields that distinguish them from the other coal basins of the country--seam formations with differing rock angles and large total thickness are developed at depths that do not exceed 550 meters. Under these conditions, the existing standard documents require the leaving of protective pillars under protected entities among the seams to safe depths, which currently still have not been reached in the majority of cases. The irrationality of the development consists of the fact that almost all existing industrial regions and cities are concentrated in the narrow belt of the assimilated coal fields.

Along with the capital construction of cities existing in the coal-bearing territories, the construction of small mining towns with local engineering service lines and their own boiler and other auxiliary structures was widespread in the past.

In recent decades, the majority of towns in the coal-bearing territories have been moved from the dangerous underworking zones. The level of residential development remaining in underworking zones in the basin, however, is still quite large, since with the transition of the mines to deeper levels the areas over workings in which the new entities fall increase. The leaving of protective pillars under residential settlements is irrational due to the

large laying up of reserves, and therefore the majority of coal regions of the oblast have adopted a policy of the complete stripping of construction from the territories over workings. Due to the insufficient capacity of construction organizations in the Kuzbass, however, the real possibilities for this in the upcoming ten years are exceedingly limited.

Every year VPO Kuzbassugol re-activates more than 5 million tons of coal under built-up territories and natural entities, of which about 3 million tons are through the transfer of entities from the zone affected by mining operations. The requirements of the association for the re-activation of reserves, however, are considerably greater than the planned volumes.

An unsatisfactory situation with regard to the fulfillment of the planned re-activation of coal reserves has taken shape in the Prokopyevsk-Kiselevsk region, where the presence of structures in the underworking zone restrains the development of mining operations. At the same time, there exists in the basin great experience in repeated working under buildings, structures and service lines without their removal, when the facilities fall in such sections of the displacement zone, where the deformation process of the ground surface flows smoothly. The movement of mines to deeper levels creates well-founded standards for the conditions for conducting work under residential settlements in the Kuzbass when conducting planning and renovation work using the manpower of special construction and repair administrations of associations in them.

Over the last 10-15 years, more than 30 major facilities of a cultural, domestic and industrial type have been worked under in Kuzbass conditions without the interruption of their functioning through the application of mining and design protective measures.

Among the protective design measures were the framing of buildings along the perimeter of the roofs ahead of time with stressed metal bands together with the splitting of the buildings into the shortest compartments, the installation of banding beams in the ground-floor level of buildings and the construction of recesses for the purpose of jacking and leveling the buildings in the process of working under them. The cost of the strengthening measures did not exceed 20 percent of the cost of the buildings.

Among the protective mining measures for buildings and structures, the Prokopyevskugol [Prokopyevsk Coal] Association employed hydraulic filling of the worked space from the crushed rock of the Usyatskaya Formation and the burnt rock of the refuse dumps, which allowed a reduction of 2-3 times in the ground surface deformation. The Leninskugol [Leninsk Coal] Association utilized the partial stoping of seams by area and thickness with short faces of 50-55 meters with the leaving of pillars between the walls at 30 meters, as a result of which the ground surface deformation was reduced by 3-4 times. The sphere of application of this mining measure for protecting facilities, however, is limited by the opportunity of the partial stoping of only one seam in a formation.

Widespread in this same association is the extraction of laid-up coal reserves under water entities. This was preceded by a large set of research and physical observations by VNIMI for determining the height of the zone of

water-permeable cracks above the stoped wall space, which permitted the establishment of safe depths for the mining of seam formations. As a result of the incorporation of the recommendations for the establishment of safe mining depths for workable seams and the erection of hydro-technical structures (dikes), 4.6 million tons of coal were re-activated over the 11th Five-Year Plan under flood-plains and rivers.

The production of coal in the Kuzbass in the area of the capital construction of cities in large amounts requires the incorporation of a group of technical and organizational measures based on the results of research on the displacement of rock and the interaction of underworking structures with the deforming foundation. VNIMI has currently developed methods of forecasting the displacement and deformation of the ground surface in the current and future planning of mining operations under individual facilities and large built-up territories, including with complex and irregularly lying rock, which permits the well-founded choice of mining and design measures for protecting underworking facilities.

The incorporation of re-activation under the built-up territories of the Kuzbass, however, is hindered by a number of unresolved problems of an organizational, scientific and technical nature. Planning organizations planning new levels include in the reserves re-activation section the complete stripping of facilities from the territories over workings, which substantially increases the estimated cost of mine reconstruction. In reality, re-activation after the introduction of a new level, as a rule, is implemented through mining costs, which has a considerable effect on the reduction of the technical and economic indicators of the enterprise, especially with the presence of dense build-up on the mining land (the mines imeni Voroshilov, Krasnogorskaya and others).

It is essential to review the existing technique of calculating the economic efficiency of coal-reserves re-activization under the built-up territories, which does not take into account factors that reduce the cost of coal through the additional production of reserves prepared for extraction, the extended service lives of mine levels, profits from the elimination of the installation and re-installation of mechanized units etc. The detriment from the loss of reserves in permanent pillars and the economic vested interest of the collective in re-activization are not sufficiently taken into account in this technique.

The existing technique for protecting buildings and structures with protective pillars should also be reworked, which does not produce effective results in the complete or partial delineation of pillars of mining operations for seam formations, as a result of which facilities located in the edge sections of the protected areas receive impermissible damage.

It is essential to set standards for allowable deformation for several structures and the technological equipment of electrified mainline railroads and to resolve issues of coordinating working under them, since due to this the planning of the re-activization of exceedingly considerable reserves of coal under railroads is still being restrained.

Furthermore, it is essential to increase the volume of coal production with the filling of worked space (in the Prokopyevsk-Kiselevsk region, for example, it does not exceed 8 percent).

In order to eliminate the causes that are restraining the re-activization of reserves in the basin, VPO Kuzbassugol, in conjunction with the associations and VNIMI, has projected the execution of a series of measures directed toward the carrying out of additional research and the elimination of existing shortcomings in the planning of re-activization, the strengthening and equipping of observation groups with the essential tools and equipment, and resolving the question of the creation of repair and construction administrations in the associations.

In the 12th Five-Year Plan, the Kuzbassugol VPO is planning to maintain the coal re-activization volume with the application of mining and design measures for protecting buildings and underworking structures at the level of 2 million tons.

The reduction of general losses of coal in the mining of thick steep inclined seams is facilitated to a considerable extent by the open working of coal losses written off earlier in the intervening pillars, the production of which totaled 12.35 million tons over the 1981-84 period in the Prokopyevsk-Kiselevsk region.

Currently, in view of the limited nature of the remaining reserves in the intervening pillars, this type of additional coal production in coming to an end in the region, but production by the open method is increasing with the working of the gently sloping seams of the northern Kuzbass, the losses in which total 8-10 percent, which is 1.5-2 times less than operating losses in underground coal production.

Some exceeding of the actual losses above those planned was caused by growth in mine losses through the writing off of reserves in permanent pillars. In upcoming years, the effect of the reserves write-off factor will increase in absolute terms through an increase in the size of pillars with depth, but as a result of the projected measures for reducing operating losses and increasing re-activization, the level of general losses will decline.

Thus, the large amount of incorporation of scientific research development carried out in the 11th Five-Year Plan permitted the Kuzbassugol VPO to reduce substantially the level of operating and general mine losses in the basin and to project measures for increasing the level of coal-reserves extraction using improved planning systems, equipment and processes for underground coal production, which meets the requirements of law for the efficient utilization and protection of the mineral resources of our country.

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UKRAINE PEAT INDUSTRY 1986 OBLIGATIONS

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[Article by A.I. Prisyazhnyy, director of Ukrtorf [Ukrainian State Trust of Peat Industry Enterprises]: "Ukrtorf Tasks for Fulfilling the 1986 Economic and Socialist Development Plan"]

[Text] The peat industry workers of the Ukraine, having put into effect the decisions of the 26th CPSU Congress and subsequent CPSU Central Committee plenums, and having overcome specific difficulties in their work resulting from weather conditions unfavorable for extracting peat, have fulfilled their planning obligations for 1985 and the five-year plan as a whole, in terms of the basic technical and economic indicators.

The 1985 plan for sale of output was fulfilled to 100.3 percent; the plan for overall peat extraction was fulfilled to 101.7 percent. The sale of output plan for the 11th Five-Year Plan was fulfilled by all production associations. Control figures for overall peat extraction were exceeded by 2.2 million tons; in terms of the total of current plans--by 2 million tons. Agriculture was supplied with almost 4 million tons of peat for fertilizer in excess of the quota.

All production associations except the Irdynskiy Association fulfilled their current five-year plans with respect to overall extraction of peat. The average level of fulfillment for Ukrtorf was 105 percent; by association: Lvovskoye--108.6 percent, Chernigovskoye--106.8 percent, Rovenskoye--105.4 percent, Sumskoye--100.6 percent, Podolskoye--108 percent, Kiyevskoye--106.3 percent, Zhitomirskoye--103 percent.

The unfavorable weather conditions of the 1982, 1984 and 1985 seasons made it impossible to fullfill plan obligations with respect to extraction of fuel peat (89.7 percent) and production of peat briquettes. The highest indicators were achieved by the following associations: Lvovskoye (97.4 percent), Chernigovskoye (92.7 percent), Podolskoye (96.4 percent).

Four peat associations (Rovenskoye, Chernigovskoye, Podolskoye and Irdynskoye) fulfilled their plans for extraction of lump peat under the complex weather conditions. The Kiyevskoye and Sumskoye Associations did not manage to fulfill their plans for extraction of lump peat.

Ukrtorf fulfilled its five-year plan for production of peat briquettes to 94 percent; the Kiyevskoye Association fulfilled the plan to 102.1 percent, Podolskoye--to 98.7 percent, Zhitomirskoye--98.5 percent, Chernigovskoye--97.5 percent, Lvovskoye--96.4 percent, Rovenskoye--91.4 percent, Irdynskoye--81.1 percent, Sumskoye--71.2 percent.

Nine peat briquette plants surpassed their five-year plans for briquette production. These included the Karpilovkiy plant (129.9 percent), Buchmanskiy (110.5 percent), Ushitskiy (109.4 percent), Mnevskiy (108.8 percent), Manikovetskiy (106.2 percent) and others.

In 1985, the most unfavorable year in terms of meteorological conditions, the Buchmanskiy, Ushitskiy, Manikovetskiy, Karpilovskiy and Zhuravichskiy peat briquette plants also fulfilled their annual plans. The secret of success of these plants was greater organization of production.

The achievement of the goals that had been set was to a great extent facilitated by plant management, party and trade union efforts to promote socialist competition in order to fulfill the tasks of the five-year plan ahead of schedule.

Among the winners of the socialist competition were the following: Ya.V. Yurchuk, a peat extraction and processing machine operator at the Stoyanovskiy Peat Briquette Plant in the Lvovskoye Peat Association, who fulfilled his three-year personal plan, was awarded the "Badge of Honour" for his work achievements, and named "Best in His Profession" and "Outstanding Worker of the 11th Five Year Plan"; N.A. Kovalchuk, a peat extraction and processing machine operator at the Karpilovskoye Peat Enterprise of the Podolskoye Association, who fulfilled his five-year plan in September 1984, and was named Outstanding Worker of Communist Labor and the 11th Five-Year Plan; M.A. Shevchenko, brigade leader of the complex lump peat extraction brigade at the Konotopskoye Peat Enterprise of the Sumskoye Peat Association, who was named holder of the 2nd and 3rd Degrees of the Order of Work Fame, and whose brigade fulfilled its five-year plan on 5 June 1985; V.V. Popovich, brigade leader of the briquette production brigade at the Buchmanskiy Peat Briquette Plant of the Zhitomirskiy Peat Association, whose communist brigade, winner of multiple intra-plant socialist competitions, fulfilled its five-year plan on 18 July 1985.

The following peat extraction and processing machine operators also achieved exceptional work results: V.A. Prishivlyuk (Litinskoye Peat Enterprise), N.G. Motora (Irvantsevskiy Peat Briquette Plant), Yu.V. Kozubovskiy (Chemernyanskoye Peat Enterprise), I.V. Yurchuk (Stoyanovskiy Peat Briquette Plant), E.F. Vasilenko (Ushitskoye Peat Enterprise), V.M. Stegniy (Shostkinskoye Peat Enterprise), P.A. Ishchuk (Smyzhskoye Peat Enterprise), and others.

The successful efforts of many labor collectives made it possible to fulfill the plan for growth of labor productivity in Ukrtorf as a whole (115.8 percent) compared with a plan target of 115.3 percent, and facilitated the achievement of fairly high output growth rates (119.1 percent).

In order to develop and maintain peat industry capacities, capital investments valued at 35.4 million rubles were realized, and construction and installation work valued at 14.9 million rubles was completed during the 11th Five-Year Plan. Planning targets in the 11th Five-Year Plan were surpassed in the following areas: residential construction, retooling, municipal construction, realization of peat and peat briquette production capacities, and construction of cultural and educational facilities. The following were realized or put into service: peat extraction capacities totalling 1,282,000 tons (the plan target was 1,256,000 tons), 24,300 m^2 of residential floor space including 1,600 m^3 in excess of the plan target, three kindergartens with 295 places, a 300-club, a school with 12 classes, a new "Soyne" Peat Briquette Plant with a capacity of 115,000 tons of briquettes. In addition, comprehensive construction is under way on the Smolinskiy Peat Briquette Plant, which will have a capacity of 30,000 tons of briquettes.

The volume of construction that was based on methods of operation employing the resources of local organizational grew from year to year, and by the end of the five-year plan was valued at 3.3 million rubles, compared with 1.6 million rubles in 1980.

The 1986 economic and social development plan calls for a 5.6 percent growth in production volumes, and a growth in sales of 3.5 percent; production will grow by 19.9 percent during the 12th Five-Year Plan.

At present, in order to achieve these plans and socialist obligations, industry work collectives are directing all their efforts towards finding additional resources to increase peat production efficiency by accelerating retooling and the implementation of scientific and technical achievements, and by utilizing generated production potential more intensively.

The basic industry tasks for the achievement of production and capital construction plans were discussed at summary production association and Ukrtorf soviets; the "Basic Industry Organizational and Engineering-Economic Measures for Achieving the Plan and Socialist Obligations for 1986, and for Increasing Production Efficiency Under New Management Conditions" were developed and approved. In light of the short supply of raw materials for briquetting, all peat briquette plants are geared for an early start of the peat extraction season; to this end, necessary measures have been put in place to ensure that peat extraction equipment, and production areas and equipment are repaired in good time.

Work conforming to plan is underway to develop a technology for briquetting peat with low-quality bituminous coal and the waste products of lignite briquette plants. In 1986, around 100,000 tons of coal, including 50,000 tons of lignite briquette crumb, are scheduled to be processed. This will make it possible to reduce the dependence of peat briquette production on weather conditions, and to use low-quality coals as fuel for municipal and everyday use.

In order to achieve planned production growth rates in 1986, output volumes for new types of peat-based products will increase: hollow peat pots (up to 20 million units), packaged peat-mineral-ammonium fertilizers (up to 8,000

tons), baled peat (up to 2,000 tons). The possibility exists of increasing the production of peat-mineral-ammonium fertilizers to 600,000 tons by centralizing the mineral component industry.

Accelerated implementation of the achievements of scientific and technical progress will form the basis of all further work in Ukrtorf. Draft plans prepared by association and peat enterprise design services call for the installation of two car dumpers at the Stoyanovskiy and Smolinskiy Peat Briquette Plants, the introduction of an automatic coal feed line at the Zamglayskiy Peat Briquette Plant, the broader use in peat extraction of wide-cutting equipment complete with high-speed energy-saturation tractors, and the completion of a number of tasks aimed at merchanizing manual labor and modernizing equipment.

The workers of the republic's peat industry will make every effort to totally fulfill 1986 planning objectives, adopted socialist obligations, and counter plans.

"Ukrtorf Association Socialist Obligations for 1986

The workers of the Ukrtorf republic industrial association surpassed the 1985 annual plan for sale of output. 132,900 tons of peat were extracted, goods valued at 759,800 rubles were produced for domestic consumption, and 3,189m^2 of residential floor space were constructed using methods based on the resources of local organizations--over and above plan targets.

Five-year sales objectives were achieved by the repair plant and all peat associations. The industry as a whole produced goods for domestic consumption valued at 3,028,000 rubles.

Guided by the decisions of the April and November (1985) CPSU Central Committee plenums, the peat industry workers of the Ukraine adopted the following socialist obligations for 1986:

--to fulfill ahead of schedule, by 30 December, the annual plan for production volume by more fully utilizing production potential, and strengthening work discipline; to turn out products valued at 250,000 rubles over and above the plan;

--to fulfill the plan for sale of products one day ahead of the deadline, and to exceed the plan by 230,000 rubles;

--to surpass the target for growth in labor productivity by 1 percent by accelerating scientific and technical progress, reducing losses in operating time, and decreasing manual labour, thereby releasing 23 workers;

--to reduce production costs by 0.5 percent in addition to the plan;

--to extract 137,000 tons of peat over and above the plan by more fully exploiting production areas;

--to produce goods for domestic consumption valued at 75,000 rubles over and above the plan;

--to economize, by improving the design of articles and implementing progressive technologies, on the following resources (based on two days' work): 825 tons of furnace fuel oil, 684,000 kilowatt hours of electrical energy, 84 tons of diesel fuel, 4 tons of metal, 16 tons of gasoline, and 1,829 gram-calories of heat energy;

--to reduce losses in operating time by 20 percent in comparison with 1985;

--to continue work on implementing brigade forms of organization and wage payment; to bring the proportion of workers in brigades with wages based on the end result of their labor to 65 percent of the overall number, and in self-supporting brigades--to 43 percent.

--to constantly improve work standardization; to introduce output norms based 98.3 percent on technical data;

--to increase the efficiency of capital investments in retooling and to realize peat extraction production capacities totalling 64,000 tons;

--to continue work on re-equipping production and improving work organization--and to this end, to implement 160 measures--and to continue work on developing new equipment; to bring the level of mechanized labor to 70 percent;

--by implementing NOT (scientific organization of labor) measures, to save 60,000 rubles through reductions in production costs, and to conditionally release 49 people;

--to obtain savings of 360,000 rubles through the implementation of cost-cutting suggestions and inventions;

--to bring into line with NOT requirements, and certify, 116 work places, and to conditionally release 130 workers;

--to produce 5,000 tons of packaged fertilizer for the population;

--to manufacture on order for farm organizations 60,000 tons of peat-based peat-mineral-ammonium fertilizer;

--to recultivate by methods utilizing the resources of local organizations, and to hand over to the national economy, 1,150 hectares of peat workings;

--to put into service 5,441 m^2 of residential floor space constructed using methods of operation utilizing the resources of local organizations;

--to turn out products made from local raw materials and industrial by-products valued at 100,000 rubles over and above the plan;

--to constantly develop tutorship; to raise the qualifications of 650 workers, and to train 160 people in advanced work methods;

--to train 500 assembly-line workers, and to train 160 of those in secondary and related professions;

--to increase the qualifications of 200 engineering and technical personnel through republic ministry technical courses;

--in every possible way, to spread and implement advanced initiatives and valuable undertakings that promote increased labor efficiency and quality.

These obligations were discussed and adopted by the peat association collectives of Ukrtorf.

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